

STOPPING HEMLOCK FROM GOING CHESTNUT: Saving Representative Hemlock Stands¹

By Francis E. "Jack" Putz

DUST OF SNOW²
By Robert Frost

The way a crow
Shook down on me
The dust of snow
From a hemlock tree

Has given my heart
A change of mood
And saved some part
Of a day I had rued.



Photo: John Burk

Of all the many forest types in New England perhaps the most evocative are the dark groves of hemlock that favor wet ravines, swamp edges, and shady stream banks. Entering into one of these forest chapels you sense that anything could happen, that time itself could stand still. But hemlock will be history in New England within the next few decades unless drastic and costly steps are taken to prevent the species from being annihilated by hordes of the hemlock woolly adelgid (*Adelges tsugae*, hereafter HWA), a small sucking insect introduced from Asia. Although some choice trees in formal landscapes are being protected and path-breaking efforts are underway to save hemlocks in a few natural stands, the hemlock groves that we so cherish seem bound to disappear within the span of a human generation.

THE THREAT

Clarion calls about pending environmental disasters are so common that they often fall on deaf ears, but it is already too late for most hemlocks in Maryland, New Jersey, and Pennsylvania. Down through the Shenandoah Valley many trees are already either dead or nearly so and the hemlocks of Connecticut are not far behind. Quite a few hemlock stands in Massachusetts are already infested with HWAs and some have already succumbed. Federal, state, and private initiatives are underway to study and control this pernicious exotic pest, but the wave of hemlock death continues to wash over the landscapes of eastern North America at 10-20 miles per year. This means that unless we mount an expensive, long-term, and coordinated campaign to save at least a few hemlock forests, it will not be long before a dusting of snow falling from hemlock branches and other poetic images will mean little.

In contrast to the ill-fated American chestnut, which persists as stump sprouts after being top-killed by blight, when a stand of hemlock is killed by adelgids, all of the trees die, from the mighty monarchs of the canopy to the suppressed and often ancient saplings in the understory. Hemlocks neither re-sprout nor regenerate from seeds lying dormant in the soil. Fortunately, there are several ways to protect individual hemlock trees, and some less well-developed ways to protect at least small hemlock forests. There are also good reasons to believe that if we can keep hemlocks in our landscapes for another decade or so, effective biological

control methods for HWAs will become available. Unfortunately, due to unawareness of the threat or concerns about the numerous assorted economic and environmental costs of treating HWAs, few trees and even fewer forests are being saved. I wish to argue that these costs are worth paying because a future without hemlock, a species of such paramount ecological and cultural value, is simply too depressing to contemplate. And regarding the issue of financial constraints, consider what you would personally pay to spend an afternoon in an old growth American chestnut forest.

THE BEAST

Hemlock woolly adelgids are small sucking insects not unlike aphids or scale insects that were accidentally introduced in Virginia in 1951. Since then the species has moved south through the range of Carolina hemlock and northwards through Massachusetts and into Maine, Vermont, and New Hampshire. Adelgids are easily transported by wind as well as on the feathers of birds and fur of mammals. They look like small black dots at the base of hemlock needles into which they insert their mouthparts and literally suck out the life juices of the tree. Much more obvious than the adults are the cottony-wax covered egg masses that appear in early spring and summer (2 generations a year); a thoroughly infested tree appears lightly dusted with snow that is not dislodged by crows. The eggs are produced asexually and therefore hemlock woolly adelgid genetic diversity is probably low and unchanging, which may make them easier to control, but so far no one has figured out how to make use of the fact that evolutionarily they are not making progress.

Once a tree is infested with HWAs, unless the infestation is treated, death usually occurs within 5-15 years. Trees near streams and in other wet areas usually survive the onslaught a bit longer, and irrigation during dry periods can prolong an infested tree's life, but eastern hemlocks that are naturally resistant to HWAs have not yet been found. Researchers still hope to discover genetically resistant individuals, which is one reason why the on-going flurry of pre-emptive felling of hemlock trees is so worrisome. Hopes for natural resistance are supported by the adelgid tolerance of western and Asian species of hemlock, but this is still a long shot.

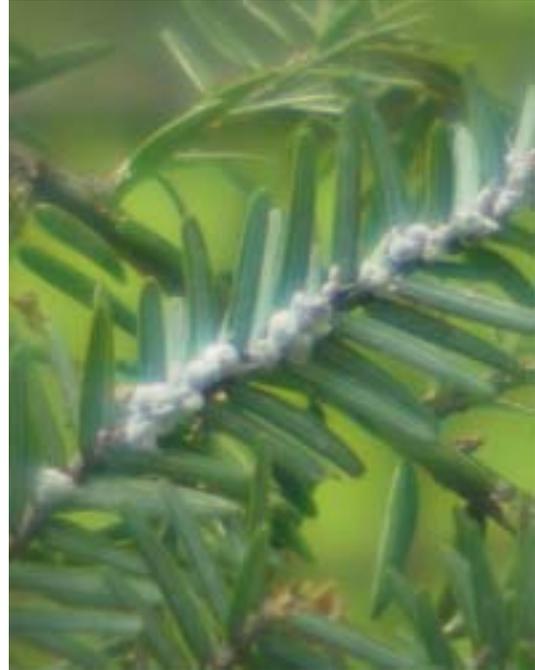


Photo: David Orwig

SOME CONSEQUENCES OF THE LOSS OF HEMLOCK

Hemlock tree deaths have profound ecological consequences, which is to be expected given the unsurpassed ecological influences live hemlock trees have on their environs. Their dense crowns cast deep shade that keeps the soil and water they overtop cool and moist throughout the summer, which is appreciated by trout and trout fisherman alike. Hemlock crown density renders the understory warmer at night during the winter, a phenomenon that is familiar to bedding deer and moose alike. Plant cover beneath hemlocks is generally sparse both because of the shade and the acids released from its decomposing needles. Other than hemlock angle moths, there are apparently few obligate hemlock specialists and hence few species that are threatened by its extirpation. Nevertheless, many forest dwellers will suffer when hemlock is no longer an important component of our landscapes. For example, when hemlocks disappear we can expect further declines in the already beleaguered populations of Acadian flycatchers, black-throated green warblers, and Louisiana water thrushes. All of these losses human beings will survive, but hardly intact.

As was the case after the loss of the once dominant chestnut of eastern North America and the less widely heralded demise of American elm, the spaces created when hemlock

trees die are colonized rapidly by other tree species, but the resulting forest is never the same. The species that benefit from the HWA invasion vary with local seed sources and other factors. Black birch often recruits first, but oaks and maples are also common beneficiaries of hemlock disappearance. It is particularly worrisome that where seed sources for exotic invasive tree species are present, such as Norway maple and tree-of-heaven, they can rapidly come to dominate. Although some people may draw comfort from the discovery by paleoecologists that an apparently similar episode of hemlock loss and replacement occurred about 5000 years ago, recovery of hemlock populations took 1000 – 1500 years and most of us operate within considerably shorter time frames.

In assessing the consequences of the extirpation of hemlocks from our forests, ravines, swamp margins, and glens we must consider the aesthetic and spiritual importance of what has long been an iconic species in the northeast. Hemlocks may have been harvested for their tannin-rich bark up through the 19th century, but the species has always played a central role in our imaginations. Just to mention hemlocks invokes a series of profound feelings and images. In contrast, in the not-too-distant future, landscape painters may be accused of inventing this deep and densely crowned species as an artistic artifice. More fundamentally, at least until hemlocks fade in our cultural memories, I suspect that future generations will not be satisfied when we explain that we let hemlock follow chestnut into oblivion because controlling HWAs cost a lot of money, because we had no easy way of killing them without hurting other invertebrates, or because we were unaware or unconcerned about the threat.

CONTROLLING HEMLOCK WOOLY ADELGIDS

Whether we choose to act in the defense of at least a few representative stands of eastern hemlocks across what remains of its original geographical range, or allow the species to effectively disappear from our natural landscapes, we should all be aware that HWAs can be controlled. Unfortunately, none of the control methods is perfect, all require substantial financial investments, and some cause collateral damage. Research on HWAs is underway, and a silver bullet should be found within the next decade, but for the time being, hemlock protectors have several options from which to choose the least objectionable. An integrated

approach to pest management is definitely recommended, starting with monitoring HWA populations, maintaining tree health, and then employing both biological and chemical control methods as needed. Containment of HWA infestations, to the extent that it is possible, is a component of an integrated hemlock protection program that is being implemented by the states of Michigan, Vermont, New Hampshire, and Maine. Extensive information about HWAs and their control is available on several informative sites on the world-wide-web (see the end of article for a list), but an overview of the options might be useful here.

Bitter Cold Helps Hemlocks

Record low temperature in January 2004 will reduce populations of HWAs and slow their onslaught through the hemlock forests of the northeast. Unfortunately, some HWAs typically survive and strong natural selection, coupled with global warming, are likely to result in northward range extensions. On the bright side, cold winters provide more opportunities to save representative hemlock stands.

Among the biological control methods being developed for HWAs, predatory beetles such as the ladybird beetle (*Pseudoscymnus tsugae*) from Japan seem the most promising. These beetles are becoming increasingly available on the market, millions have already been released, and they show great promise of being effective in reducing HWA populations. Several other predatory species will soon be permitted for release, and researchers are confident that by using a combination of biological control agents, we will eventually be able to save hemlocks without using insecticides, if there are any left to save.

If you or your contractors are going to resort to chemical control methods for HWAs, a variety of options are available, some only to licensed applicators. Systemic insecticides, usually imidacloprid, can be injected into individual tree stems or into the soil under selected trees. Imidacloprid probably kills native hemlock herbivores, but treatment effects against HWAs reportedly persist for at least two growing seasons, which is an advantage. Because imidacloprid is extremely toxic to aquatic invertebrates, it should not be used within 50 feet of surface water or in shallow-to-groundwater locations, conditions that unfortunately occur in much of the prime hemlock habitat in our region. Although deep-

pocketed hemlock protectors might consider treating entire stands with imidacloprid, it seems more appropriate as a treatment for specimen trees in formal or natural landscapes.

A variety of chemicals applied to hemlock foliage are known or expected to be effective in HWA control. Horticultural oils with a mineral or vegetable base kill HWAs by smothering them. Formulas for organic horticultural oils using cottonseed or soybean oil are well known among organic farmers, but their effectiveness on HWAs has apparently not been tested. Some liquid soaps, including Doctor Bronner's Peppermint Pure-Castile Soap, kill HWAs by disrupting their cuticles and should prove useful in some settings. Pyrethrum, an organic insecticide based on chemicals in the flowers of an African chrysanthemum, also kills HWAs along with any other invertebrates it contacts, but is harmless to vertebrates and is rapidly degraded by sunshine. Other insecticides also probably work against HWAs, but most people who are trying to save hemlock trees are also concerned with the welfare of other species and probably steer clear of the more toxic options.

Foliar applications of horticultural oils, insecticidal soaps, or broad spectrum insecticides are all hampered by characteristics of hemlock trees that make them so special. In particular, the dense crowns that cast such deep shade are wonderful to behold but make it difficult to drench every needle with the active compounds. And then there is the problem of access; most of our most valuable hemlocks grow in steep rocky ravines and other sites that are not readily accessible to bucket trucks and other vehicles. I wonder whether some combination of spraying downwards from helicopters or crop dusting airplanes and fogging upwards from the ground might work, at least at the 5-20 acre scale.

Widespread application of insecticides, even something as innocuous as pyrethrum, seems outlandish until it is considered that each year millions of acres are sprayed with much more toxic compounds to control gypsy moths, spruce budworms, and the mosquitoes that carry West Nile Virus and Equine Encephalitis, not to mention the familiar visits by malathion-spewing mosquito trucks that make suburban neighborhoods comfortable for picnics. The sorts of gasoline-powered foggers that tropical biologists use in their studies of canopy insects also have great promise for HWA control. Shoulder-mounted versions that cost less than \$2000 can propel fog-sized droplets much more

than 100 feet upwards through the dense crowns of rain forest trees—I suspect that they would work well on HWAs in hemlock forests as well.

SAVING REPRESENTATIVE STANDS OF HEMLOCK

Given the geographical distribution of eastern and Carolina hemlock, efforts at saving representative stands might best be coordinated by a federal agency, such as the U.S. Forest Service but with full participation by state and private forest owners and managers. The expertise in private tree care companies should also be tapped. The coordinating body needs to make sure that resources are deployed efficiently and that information about control methods is rapidly disseminated. Good communication is critical lest private owners of hemlock forests who are unaware of the assistance available incur unnecessary expenses and cause avoidable damage to themselves or the ecosystems they are trying to protect. Another task that the hemlock-saving coordinating body will need to assume early-on is developing a protocol for identifying which stands are most important to save. Some of the criteria that will most likely prove useful in this triage process include stand size, geographical location, accessibility, maturity, and degree of isolation from untreated stands. Old growth and stands with owners willing to cost-share in HWA control might also be favored. Then there is the issue of how many stands to treat. It is already too late to save some hemlock forests, but there are still plenty of beautiful stands from which to choose.

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Walk through a real live hemlock forest.

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Ride the giant woolly adelgid.

The considerable financial costs of protecting hemlock stands from HWAs need to be weighed against the costs of allowing the trees to be killed. In these calculations we can probably disregard lost revenues from the sale of hemlock wood, which hardly pays the freight, and there is currently no market at all for tan bark. In contrast, there may be substantial costs associated with keeping people out of areas with dead hemlock trees until all the trees have fallen. It would of course be even more costly to allow continued visitation in stands where injuries from falling trees are very likely.

Given the value that many of us place on hemlock forests and the continuing laments about the loss of American chestnut, a species rapidly fading from living memory, we should be able to muster the resources needed to keep hemlock woolly adelgids at bay in at least a few stands. As time goes by these few protected areas are certain to increase in value as a living memory of the once extensive forests we now cherish. Furthermore, they will serve as reference states and seed sources for hemlock forest restoration when the adelgid problem is eventually solved.

¹A portion of this article appeared as "Hope and the Hemlock" in *Sanctuary: The Journal of the Massachusetts Audubon Society* 43: 10-11 (Winter 2003-2004).

²"Dust of Snow" from *The Poetry of Robert Frost* edited by E.C. Lathem. Reprinted by permission of Henry Holt and Company, LLC.

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Sources of Additional Information

<http://www.fs.fed.us/na/morgantown/fhp/hwa/hwasite.html>

www.ecoscientificsolutions.com

www.savethehemlocks.net

<http://www.dynafo.com/home.html>

<http://www.bartlett.com>

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